

Einladung

Würzburger Mathematisches Kolloquium

Julius-Maximilians-Universität Würzburg • Institut für Mathematik

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Friedrich-Alexander-Universität, Erlangen

Machine Learning from an Applied Mathematician's Perspective

Dienstag, 10. November 2026 • 14:15 Uhr

Seminarraum SE41 • Humboldt-Bau (Emil-Fischer-Straße 41, 97074 Würzburg)

Der Vortrag wird auch als Zoom-Meeting übertragen: go.uni-wue.de/ifmcolloquium-zoom

Abstract. Machine Learning has emerged as one of the most transformative developments in contemporary science and technology. In this lecture, I will discuss it from the perspective of applied mathematics, emphasizing its connections with approximation theory, control theory, partial differential equations, and numerical analysis. The presentation will be organized around four central themes: representation, generation, numerical approximation, and hybrid modelling.

We begin by exploring the links between Machine Learning and control theory, viewing deep neural networks as dynamical systems. This perspective provides insight into two fundamental questions: how neural networks represent complex information and why they are able to generalize beyond the data used during training.

We then turn to generative diffusion models, showing how ideas rooted in the classical study of heat propagation, diffusion processes, and their time reversal contribute to understanding the mechanisms underlying their remarkable generative capabilities.

Next, we examine neural networks as tools for scientific computing. While they open new possibilities for approximating solutions of partial differential equations, they also give rise to optimization landscapes and approximation mechanisms whose mathematical properties can differ substantially from those encountered in classical numerical analysis.

We conclude by discussing HYCO — Hybrid Cooperative modelling, a strategy for constructing mathematical models of physical systems from data by combining mechanistic knowledge with learned components.

Overall, the lecture will illustrate how classical ideas from applied mathematics are contributing to the emerging mathematical foundations of Machine Learning, while Machine Learning itself is generating a rich collection of new mathematical questions and opportunities for future research.



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<https://www.mathematik.uni-wuerzburg.de/de/aktuelles/kolloquium>

Alle sind herzlich eingeladen.

Die Dozentinnen und Dozenten der Mathematik

